

A PHOTO DEPARTMENT

can make more than just pictures...

Some managements tend at times to think of the photographic department merely as the place to call when a man is needed to point a camera and say "Hold it, please."

Today there is also other work to be done. Some of this new work doesn't look much like what the layman regards as photography. But it *is* photography. It uses photographic materials and methods for purposes that management can hardly look upon as "overhead" or "burden."

Today a photo department alert to its opportunities can pitch in to such vital tasks as the fabrication of tooling and even of some of the actual working parts of products being manufactured. In a large organization, a photo department can greatly enhance its position by enterprise in seeking out photographic (or potentially photographic) operations that other departments are attempting to carry out on their own.

It happens that much of this new type of work that plant photo departments have been getting into is based on the unique properties of photographic plates. The old photographic plate has returned in a new role. It no longer merely records.

This pamphlet tells about some of these new plates and what is being done with them. If it stimulates a few thoughts and perhaps some action, please ask for any further information that may be wanted from

EASTMAN KODAK COMPANY

Special Sensitized Products Division

Rochester 4, N. Y.

Area Code 716 / LOcust 2-6000 / Extension 2374

Kodalith

Ortho Plate (Type 3)

More photographic departments have found more uses for this plate than any other.

It is the ideal storage medium and bearer of drawings and other graphic information for situations where engineers depend not on reading off dimensions but on recovering the original geometrical configuration with the least possible distortion.

It yields either a very high density or a density so low it can scarcely be measured, nothing in between. It is designed for reproducing lines, solid blocks, or spaces between blocks but never tonal gradations. It has the ideal dimensional stability that only glass provides.

For example, the plate serves as a photo-template for metal-cutting. In one advanced device employed in heavy metal fabrication, a light beam passing through a KODALITH Ortho Plate to a photocell, directs flamecutters that translate the drawing reproduced on the plate into the outlines of gigantic structural elements. It has been used regularly in the making of hulls for ocean tankers and airplane wings. A second plant in another part of the country can take the plates and automatically cut exact copies. Duplication of sections for repair are handled similarly. Storage space that used to be needed for enormous templates is released.

Another widespread use of photo-templates occurs in the electronics industry, where the individual end-products are smaller than hull plates for ships but make up for it in production volume. It is from a pattern on a KODALITH Ortho Plate that the intricate configuration of a printed circuit starts its automatic journey through the production line.

The plant photographic department that wins the all-important assignment of preparing photo-templates will find that certain recent improvements in KODALITH Ortho Plates make the work go more smoothly than formerly. Even though the emulsion has extreme contrast, there is now much exposure latitude. This has been achieved by greatly widening the degree of control that can be exercised during development. Since it is no longer necessary to keep the development time within narrow limits, you can compensate by development for variations in photographing the original patterns.

A plate from the photo department can automatically guide equipment that cuts out an enormous sheet of steel.



Kodak

Translucent Plate

Many quality control groups use optical comparators for their inspection work. Idea is to *compare* a part off the production line (or from the model shop) with a chart that shows dimension tolerances and contours for the part. The selected part is projected against the chart, and an operator makes a control judgement of "Go - No Go."

Consider that chart. If it's to be used for some time and if tolerance lines are to mean much, it must first be *dimensionally stable*. Kodak glass plates perform well on this count, maintaining their shape even in conditions of heat and humidity. Their expansion characteristics (shown in graphs on the next page), if matched against those of plastic-base charts, point up the advantage of glass.

Next, the chart material must be an *efficient light-diffusing medium*. For two important reasons: first, to catch all the fine detail of the image being projected onto it; second, to prevent human eye fatigue caused by incomplete diffusion that shows up as "hot spots" or areas of glare.

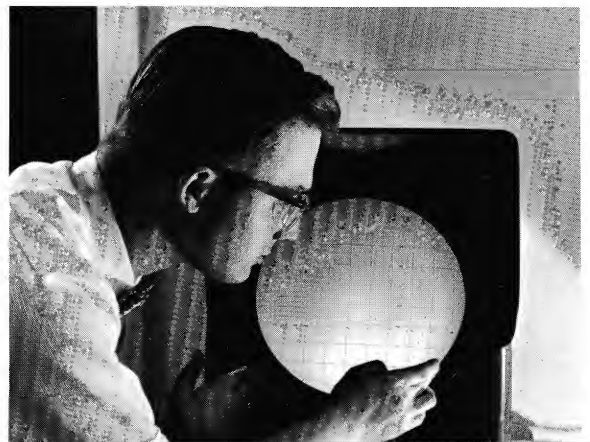
On KODAK Translucent Plates you can make comparator charts that are stable dimensionally and diffuse far better than ground glass. They yield a photographic pattern of clean black lines that stand out clearly against the projected part being inspected. They allow comfortable viewing over extended periods of time. Application of a protective lacquer (or even deliberate swabbing with oil) does not affect their diffusion qualities.

Essentially, an optical comparator chart is a *photograph* of a drawing. For reproducing line and shadow images needed in chart work, the high contrast and moderate speed emulsion of KODAK Translucent Plates is ideal. It can be exposed either in conventional copying cameras or by contact printing.

Because of their stability and high transmission in unexposed areas (over 80% for normally incident light) *and* because they can be marked easily with pencil or pen, these plates are also useful as instrument dials, templates, camera-back grids.

Rectangular plates are available in all standard sizes. Circular plates can be supplied to fit popular makes of comparators.

The inspection department can get the chart-gages for its contour projectors from the photo department.



Here's how KODAK High Resolution Plates are put to work in the microelectronics industry . . . (just one of the fields where they find application).

Making a typical logic circuit requires introducing a number of functional components to the surface of a silicon wafer. This is often done in a series of steps: each time, the wafer is coated with a light-sensitive resist;* then, the wafer is exposed to light through a photographic mask.

The mask used is a KODAK High Resolution Plate that bears a photograph of a line drawing made of the component. Areas of the resist coating left unexposed by the mask are easily removed by a solvent rinse. Etching these areas leaves a line pattern (in fact, a photo-engraving) on the wafer surface.

A series of diffusion processes — following each mask-and-etch step — successively deposits the various elements of the circuit along the line patterns.

This use of KODAK High Resolution Plates points up many of their characteristics that may be of interest to an industrial photographer. Look at it this way — suppose you need to reproduce a drawing of intricate lacework, going from a 100× (or more) original to a microminiature electronic circuit. What kind of photographic material would you look for?

1. You'll need extreme dimensional stability, because often you'll be working with a whole series of masks that have to work in successive register. Dimensional tolerances will be about as rigorous as encountered anywhere in industry. That's why you'll need glass plates.

2. You'll need extremely high resolving power. This emulsion is capable of resolving more than 2,200 lines per millimeter, or 55,000 lines per inch. (By way of microscopic boast, you can put 18,000 pages of the

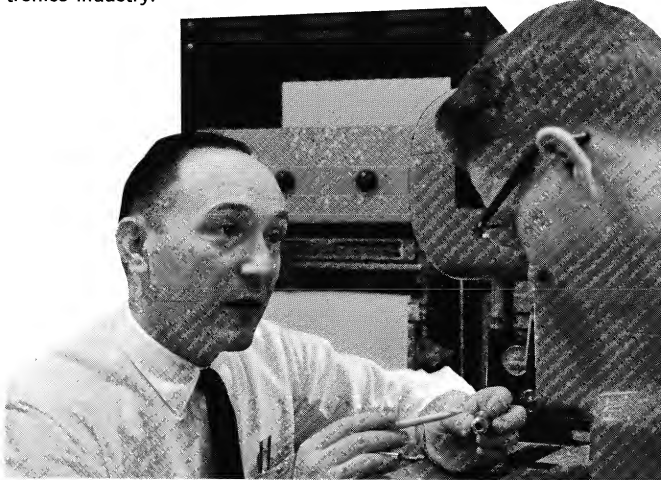
*We suggest either KODAK Metal Etch Resist or KODAK Photo Resist. Information available.

Encyclopedia Britannica on a single one of these plates, size 2" x 2".) This resolving power and extremely high contrast are other good reasons why photography handles this exacting job, and why you'll need KODAK High Resolution Plates.

In addition to microelectronics manufacture, KODAK High Resolution Plates have won a major place in such fields as reticle and optical instrument making, where accurate spacing of calibrations is important; in high-density data storage, code wheels, and encoder discs; and making miniature gages to otherwise prohibitive tolerances.

If you're thinking about a use you might have for these plates, keep in mind this assurance: KODAK High Resolution Plates are made and inspected with extraordinary precautions against microscopic defects.

From tiny photographic plates start the manufacturing operations for the new microscopic circuitry sweeping the electronics industry.



Why glass?

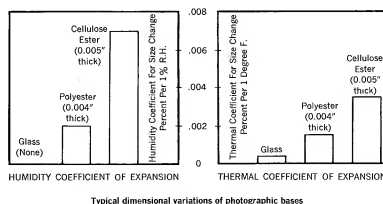
The support base for Kodak plates is glass. (KODAK PHOTOPLAST Plates, which can be readily machined, are made on methyl methacrylate plastic.)

Dimensional stability of glass

Glass has yet to be surpassed as a base for photographic emulsion in critical applications where dimensional stability is paramount. Glass has even greater dimensional stability than the famous steel gage-blocks used for standardizing measurements. It is three times as stable as aluminum. Glass has a humidity coefficient of zero and temperature coefficient of .0000045" per inch per degree Fahrenheit. Dimensional changes even to this minute extent are always truly reversible. High-strength soda lime glass is used for Kodak plates.

Except for 1/4"-thick plates, Kodak glass is flat drawn and fire-polished. Very little surface wave is tolerated. (1/4" "Micro

Flat" glass, available on special order, does not depart from a true plane by more than 0.00002-inch per linear inch. It meets the most critical requirements of ballistic camera use.)



Dimensional stability of emulsion layer

Glass effectively limits the dimensional changes possible in the emulsion. This layer expands only in accordance with the temperature coefficient of the glass base. Because the glass plate does not absorb

water, there is no processing size change or later shrinking of the base on drying. It is therefore unnecessary to consider these effects, as must be done with film or paper.

During processing, the rigid glass support restricts the slight swelling of the emulsion layer to a direction perpendicular to the image plane. With large changes in humidity, expansion or contraction of the emulsion amounts at most to a minute bowing of the plate surface.

Storage of plates

Glass can be kept in "libraries" almost forever without dimensional change. Processed Kodak plates undergo no age shrinkage, no loss in moisture or solvents from the base and are, of course, non-flammable.

Incidentally, photographic glass plates were our original product. Everything else grew out of them.

Kodak Photoplast Plate

This is not a glass plate. Instead, its base is optically clear methacrylate plastic. Because of the easy machining permitted by this support for the image — sawing, drilling, turning, planing — the use of KODAK PHOTOPLAST Plates in industry is wide open to imaginative applications.

Instrument dials are a good case in point. The actual exposed and processed photographic plate becomes the finished dial. The photographic department can make a rigid, high-impact instrument panel with trademarks, symbols, lettering, and clearly legible calibrations — ready for installation.

KODAK PHOTOPLAST Plates are also used to make architectural or equipment layouts. They work ideally as visual aids in setting up interior designs. Scale models of furniture and equipment can be moved around on the layout to find the optimum arrangement. The exposed PHOTOPLAST Plate becomes the actual layout board. In some cases the models can also be built from PHOTOPLAST Plates bearing reduced drawings.

Other uses for these plates include photo-templates of various kinds, code wheels and other programming devices that store information to guide automatic equipment, photo-lettering disks, charts for optical comparators.

Here are some of the things you can do with PHOTOPLAST Plates:

1. Back-light them or edge-light them for illuminated panels.
2. Reproduce linework for flow charts and schematic diagrams. (They resolve more than 200 lines per millimeter.) They can be reversal-processed for a pattern of clear-on-black. They have the same high-contrast emulsion as KODALITH Ortho Plates (Type 3) with the same wide expo-

sure-development latitude. They carry anti-halation backing.

3. Machine them to tolerances of 0.001". Saw, drill, thread, shape, or rout them with accuracy. The non-shattering transparent base isn't bad for dimensional stability. The smooth surface can be easily cemented to other materials.
4. Work out production techniques based on receiving the unexposed plate in widths up to 30 inches and almost any length. Standard thicknesses are .060", .130", and .250".

The photo department can put images on rigid plastic plates, and the machine shop takes it from there.





KODAK PHOTOPLAST PLATES (Improved Type)

KODAK PHOTOPLAST Plates (Improved Type) have an extremely high-contrast, orthochromatic emulsion on a shatter-resistant, readily machinable, optically clear, acrylic plastic base. The improved-type plate is manufactured by a new technique and incorporates antihalation protection (which disappears during processing), resulting in photographic performance superior to that of the older-type plate. Designed primarily for reproducing line work, the PHOTOPLAST emulsion has extremely high resolving power (above 225 lines per millimeter at a test-object contrast of 1,000:1) and extremely fine granularity. Because the clear acrylic plastic base can easily be machined into almost any configuration, PHOTOPLAST Plates find many applications in industry.

KODAK PHOTOPLAST Plates have been used successfully to make high-quality photographic master images for optical gaging and instrumentation, for templates and layouts, for electronic-computer-code and photocomposing discs, and for light attenuation in instrumentation. Since the finished plate can be viewed by backlighting, it proves ideal for illuminated instrument panels and controls, aircraft panel boards, and illuminated name plates or displays. The "light-piping" characteristic of the plastic base lends the plate to applications involving edge-lighted advertising displays.

After exposure and processing, KODAK PHOTOPLAST Plates can be cut or machined, drilled, threaded, shaped, or routed with accuracy. They can easily be cemented to other materials or surfaces (See "Finishing Operations.")

Safelight Data:

Use a KODAK Safelight Filter, WRATTEN Series 1A (light red), in a suitable safelight lamp with a 15-watt bulb at not less than 4 feet from the plate.

EXPOSURE DATA

Contact Printing:

KODAK PHOTOPLAST Plates (Improved Type) can be printed by contact with the light from a "beehive"-type safelight lamp that is equipped with a KODAK Safelight Filter, WRATTEN Series 00 (yellow), and a 25-watt bulb at a distance of about 4 feet. With average line negatives, an exposure of approximately 5 seconds will produce good results.

Exposure Indexes for Camera Use:

These indexes are for use with meters marked for American Standard (ASA) Film Speeds or Exposure Indexes. They take into account the ultraviolet absorption of average process lenses.

Tungsten — 8
White-Flame Arc — 12

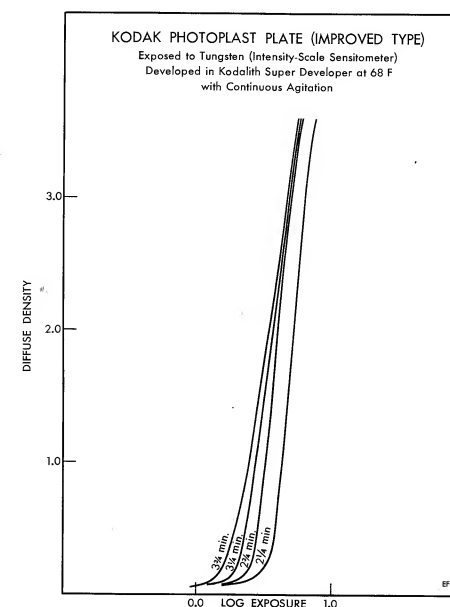
The above indexes apply to incident-light meters used directly and to reflected-light meters used with the KODAK Neutral Test Card (18-percent gray side) at the copy board. A white-matte card will serve — in which case, expose for 5 times the calculated exposure time.

Exposures calculated from the exposure index and the f-number of the lens are correct only when the lens is focused at infinity. However, in most applications of KODAK PHOTOPLAST Plates, the lens is focused either for same-size copying or for some moderate enlargement or reduction. In such cases, multiply the calculated exposure by the appropriate factor to obtain the correct exposure. The table on page 3 indicates the amount by which the calculated exposure must be multiplied for a few typical situations. For other reproduction ratios, use the KODAK Graphic Arts Exposure Computer. If the lens is calibrated in aperture ratios, the exposure modifications are not necessary, since the aperture ratios include the magnification correction.

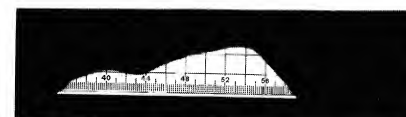
Reproduction size (percent of original size)	25%	50%	100% (Same size)	150%	200%	300%
Multiply calculated exposure by	1.6	2.2	4.0	6.5	9.0	16.0

SENSITOMETRIC DATA

Characteristic Curves: For average product and average processing.



Color Sensitivity: Orthochromatic



Spectrogram to Tungsten Light

PROCESSING DATA

NOTE: When dimensional stability is critical and the finished plate is required for use on the day of processing, best results can be obtained by holding the overall time of the processing cycle to the minimum required for good photographic results. Use of the recommended fixing and rapid-washing procedures will reduce water absorption in the base, thereby facilitating a more rapid return to room equilibrium after processing.

Develop at 68 F (20 C), with continuous agitation, for the approximate times given below:

KODAK Developer	Development time (in minutes)	
	Optimum	Useful Range*
KODALITH	2 1/2	2 to 3 1/2
KODALITH Super	2 3/4	2 1/2 to 4 1/2
D-85	2	N.R.†
Highlight Masking	5	N.R.†
KODALITH Liquid (1:4)	2 3/4	2 1/2 to 3 1/2

*Within this range of development times, satisfactory results can usually be obtained.

†Variation from the optimum time is not recommended.

Rinse the plates in KODAK Indicator Stop Bath or KODAK Stop Bath SB-1a at 65 to 70 F (18 to 21 C) for about 10 seconds with continuous agitation.

Fix at 65 to 70 F (18 to 21 C) for the approximate times given below or for twice the time required for the plate to clear. Agitate plates frequently during fixing.

Fixing Bath	Fixing Time (in minutes)
KODAK Fixer	2 to 4
KODAK Fixing Bath F-5	2 to 4
KODAK Rapid Fixer	1 to 2

Wash for about 10 minutes in running water at 65 to 70 F (18 to 21 C).

Rapid Washing Procedure (for faster return of base to room equilibrium):

KODAK Hypo Clearing Agent can be used after fixing to reduce washing time and conserve water. First, remove the excess hypo by rinsing the plate in water for 30 seconds. Then bathe the plate in KODAK Hypo Clearing Agent for 1 minute, with moderate agitation, and wash for 1 to 2 minutes, using a water flow sufficient to give at least one complete change of water during this time.

Eradicating Background. When necessary, abrasion marks, safelight fog, chemical fog and other unwanted background marks, usually the result of accidental mishandling of PHOTOPLAST Plates, can be removed as follows: Treat the marked or fogged plates in KODAK Farmer's Reducer*, or KODAK Farmer's Reducer R-4a †, or in KODAK Nonstaining Reducer R-14 ‡.

After reduction, wash plates for 5 minutes in running water and dry as recommended below.

Dry in a dust-free place in a current of air at temperatures up to 120 F. Any tendency for the formation of drying marks can be minimized by treating the plate in KODAK PHOTO-FLO Solution after washing or by wiping the surfaces carefully with a damp KODAK Photo Chamois or a soft viscose sponge. After they are dry to the touch, at least two hours is required to bring PHOTOPLAST Plates to the humidity equilibrium that produces results consistent with the low humidity coefficient of the base.

*Available in prepared packages.

†See formula and instructions in Kodak Pamphlets No. Q-11, Kodak Formulas for the Graphic Arts or J-1, Processing Chemicals and Formulas.

‡See formula and instructions in Kodak Pamphlet No. Q-11, Kodak Formulas for the Graphic Arts.

FINISHING OPERATIONS

Further information for performing the following operations can be obtained by writing to the Special Sensitized Products Sales Division, Eastman Kodak Company, Rochester 4, New York.

CAUTION: Most lacquers contain solvents that are severe crazing agents for acrylic plastic. When using commercial lacquers on the emulsion side, you must mask, cover, or otherwise protect the back surface of PHOTOPLAST Plates to prevent solvents in the lacquer from harming the base material. The use of masking tape or paper is suggested. This will also help prevent scratching of the plastic base, and when used on the front surface, will protect the emulsion from abrasion and scratching.

Shaping

KODAK PHOTOPLAST Plates (Improved type) machine extremely well; the processed plates can be sawed, cut, or machined to a tolerance of plus or minus .001 inch. However, these operations must be performed after exposure and processing.

As a general rule, sawing with various types of power saws is the best method of cutting. Steel-rule die cutting, as well as scoring and breaking can be performed on the plates that are 1/16 (.060)-inch thick. Turning, routing, drilling, tapping, and threading operations can also be performed on the finished plates.

Image Protection

The image side of KODAK PHOTOPLAST Plates can be protected by wax or lacquer applied in the following manner.

Waxing

Use a good grade of commercial paste wax. Liquid waxes should not be used. Apply the wax in thin, even coats and polish by rubbing lightly with a dry, soft cloth, such as cotton flannel. The back surface can be waxed in the same manner if desired.

Lacquering

Use a clear, automotive-type spraying lacquer or acrylic spray — such as Krylon No. 1303 clear, acrylic spray. Lacquering by roller coating or dipping is not recommended. Follow manufacturer's directions carefully. Because most spray preparations require careful application for satisfactory results, use a piece of ordinary clear glass for a trial before applying the spray material to a finished PHOTOPLAST Plate.

Cementing and Painting

Acrylic plastic and other materials can be readily cemented to PHOTOPLAST Plates by using recommended solvent-and cement-type bonding techniques. Painting of the back surface of PHOTOPLAST Plates (desirable for some applications involving instrument panels, aircraft panel boards, etc) can also be done by using recommended paints and techniques.

PHYSICAL CHARACTERISTICS

Base material	clear methyl methacrylate
Thermal coefficient of expansion (base and emulsion)	3.9×10^{-5} in./in./° F*
Humidity coefficient of expansion (base and emulsion)	0.8×10^{-5} in./in./%R.H.*
Refractive index (acrylic base only)	1.485—1.500
Specific gravity (acrylic base only)	1.18—1.19
Luminous transmission	91 to 93% (depending on thickness) over visible range

*Expansion in KODAK PHOTOPLAST Plates, (Improved Type) is uniaxial to within 0.002 percent.

SIZE AND ORDERING DATA

Orders for KODAK PHOTOPLAST Plates (Improved Type) should be placed through the nearest Kodak dealer.

KODAK PHOTOPLAST Plates (Improved Type)

Size (in inches)	Thickness of Base (in inches)	Plates per pkg
8 X 10	0.060	12
8 X 10	0.130	6
8 X 10	0.250	4

PHOTOPLAST Plates are also available on special order in any desired rectangular or square size from 4 by 5 inches to 30 by 40 inches. For further information about KODAK PHOTOPLAST Plates (Improved Type), write to the Special Sensitized Products Sales Division, Eastman Kodak Company, Rochester 4, New York.

Special Sensitized Products Sales Division

EASTMAN KODAK COMPANY • ROCHESTER 4, N.Y.

KODAK PHOTOPLAST Plates (Improved Type)

6-62 Major Revision
220-L-KP-E

KODAK Pamphlet No. P-34

Printed in the United States of America

Whittle While You Work

Methyl methacrylate—a clear, rigid acrylic plastic—has one outstanding property when used as a support for a photographic emulsion: you can whittle it. That's right, you can cut it, saw it, drill it, thread it, machine it, rout it, plane it, turn it, form it, tap it, and score it into any shape, size, or configuration you wish. If a piece of methyl methacrylate contains a suitable processed photographic image, you can whittle it into templates for layouts and macroprinted circuits, into electronic-computer code and photocomposing discs; and into back-illuminated instrument panels, dials, nameplates and displays.

We make photographic plates using methyl methacrylate for the base; our naming committee chose to call them KODAK PHOTOPLAST Plates.

The orthochromatic emulsion of these plates has extremely high contrast, a resolving power above 225 lines per millimeter (for test-object contrast of 1,000:1) and a tungsten speed of 8. Antihalation protection is incorporated.

Use is simplicity itself. First, expose the plate either in a camera or by contact; second, process and dry as directed in *Kodak Photoplast Plates* (Kodak Pamphlet No. P-34); third, whittle into whatever shape you need.

Conventional machine-shop equipment can be used for the whittling. You can lacquer the plate, paint the back, or cement the plate to another material for mounting—if any of these operations are required for your use.

Back to that methyl methacrylate base. It is clear and the plates have a thermal coefficient of expansion of 3.9×10^{-5} in./in./degree F. The humidity coefficient of expansion is 0.8×10^{-5} in./in./percent R.H., the index of refraction ranges from 1.485 to 1.500, and the luminous transmission is 91 to 93 percent, depending on thickness.

We stock 8 x 10-inch sizes, 0.060 inch, 0.130 inch, and 0.250 inches thick. We can make (on special order) sizes up to 30 by 60 inches (in certain thicknesses only). If you think that KODAK PHOTOPLAST Plates can do a job for you, call or write to the Special Sensitized Products Sales Division (area code 716, 562-6000, extension 2374), Eastman Kodak Company, Rochester 4, New York. Ask for KODAK Pamphlet No. P-34. Ask for prices. Ask for delivery schedules. Ask Bill Swanton, a nice guy with six kids and one on the way, who answers the phone at extension 2374. He will help with information and will also help you place an order through your Kodak dealer.

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T. M. Reg. U.S. Pat. Off.

Ordinary band saws, circular saws, or jig saws are used to cut PHOTOPLAST Plates. Circular saws should be 8 to 10 inches in diameter, operating at 3400 rpm. Blades should be $\frac{3}{32}$ inch to $\frac{1}{8}$ inch thick with 6 to 8 teeth per inch, alternately set and filed radially.

Best results in drilling PHOTOPLAST Plates are achieved by repointing twist drills commonly used for metals. The point should have the cutting edge ground to a zero rake angle to give a scraping action. The included angle of the point should be 55 to 60 degrees. Moderate speeds and light pressure should be used.



Now There Are Five

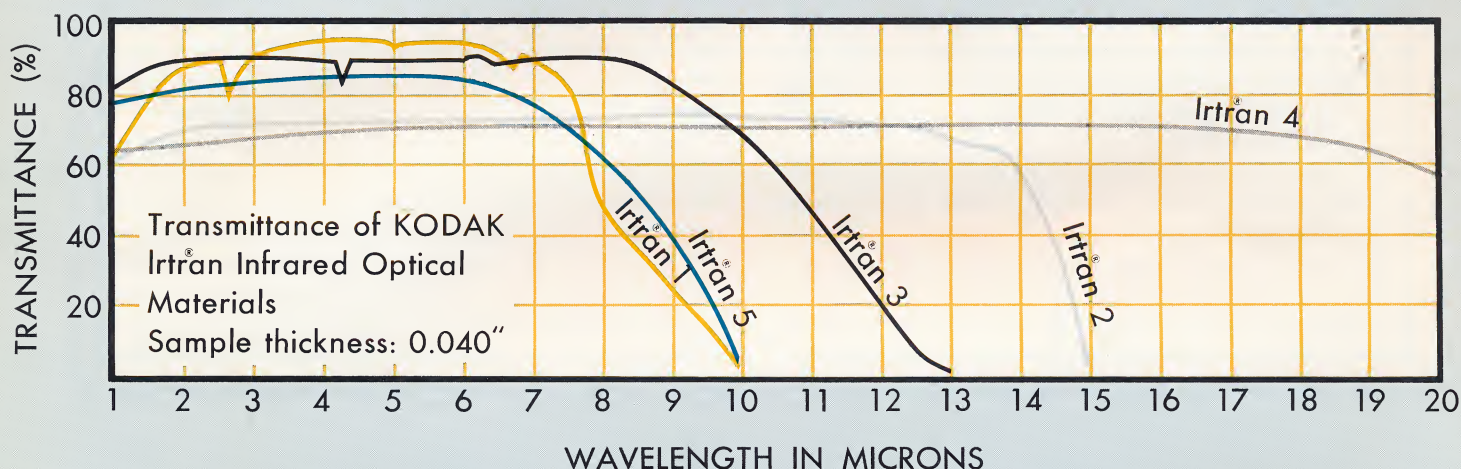
Infrared engineers who are "in the know" have long recognized the extensive capabilities of our infrared laboratory. Pardon us if we brag a little, but we're quite proud of the families of filters, lenses, optical materials, detectors, and laser materials we have developed especially for infrared optical systems. We've even got some pretty sharp engineers who do consulting on infrared-system design.

In the heart of many infrared optical systems and infrared electro-optical systems you find one of the KODAK IRTAN Infrared Optical Materials in the form of lenses, domes, windows, prisms, or filter substrates. Recently, that infrared laboratory we were bragging about developed another member for the IRTAN Materials family: KODAK IRTAN 5 Infrared Optical Material.

The table below summarizes some of the salient char-

acteristics of the IRTAN Materials. And here are a few more facts we couldn't fit into the chart: IRTAN 1 Material has excellent electrical characteristics (dielectric constant of 5 out to 9.4 Gc). IRTAN 2 Material is outstanding for lens systems (in fact, we stock a series of $f/1.0$ lenses). IRTAN 5 Material has no 2.7μ water band and, because of its high reflectance over the 15μ to 25μ range, it is excellent as a *reststrahlen* plate. All five IRTAN Materials can be physically worked in the same manner as glass and possess more desirable physical and chemical properties than other types of infrared optical materials.

If your curiosity is aroused and you would like more data, write to the Special Products Sales, Apparatus and Optical Division, Eastman Kodak Company, Rochester 4, N. Y. Write to us whenever you have an infrared problem.



KODAK IRTAN Infrared Optical Materials

Properties		IRTRAN 1	IRTRAN 2	IRTRAN 3	IRTRAN 4	IRTRAN 5
Optical Type	Type of Material	Polycrystalline magnesium fluoride	Polycrystalline zinc sulfide	Polycrystalline calcium fluoride	Polycrystalline zinc selenide	Polycrystalline magnesium oxide
	Useful transmittance ¹	0.45 to 9.2μ	0.57 to 14.7μ	<0.20 to 11.5μ	0.48 to 21.8μ	0.39 to 9.4μ
Physical	Refractive index range at 25 C	1.3708 at 2.1526μ to 1.3122 at 6.238μ	2.2616 at 2.1526μ to 2.1507 at 13.0μ	1.4324 at 0.6563μ to 1.3444 at 8.25μ	2.448 at $1.0\mu^2$ to 2.408 at 10.0μ	1.723 at $1.0\mu^2$ to 1.596 at $6.0\mu^2$
	Hardness	576 Knoop	354 Knoop	200 Knoop	150 Knoop	640 Knoop ²
	Density	3.18 gm/cc	4.088 gm/cc	3.18 gm/cc	5.267 gm/cc	3.58 gm/cc ²
	Useful temperature limit in air ³	more than 900 C	more than 800 C	more than 1000 C	more than 300 C	more than 800 C
Chemical Resistivity	Thermal conductivity (calories/sec/cm ² /°C/cm)	56 C 0.035 179 C 0.026	54 C 0.037 174 C 0.026	80 C 0.019 176 C 0.015	54 C 0.031 171 C 0.021	36 C 0.104 ² 168 C 0.070 ²
	Water immersion	no change in transmittance	no change in transmittance	no change in transmittance	no change in transmittance	transmittance is reduced ²
	Inorganic immersion	unaffected by dilute acids and alkalis, salt solutions	slight solubility in dilute HNO ₃ , H ₂ SO ₄ , unaffected by dilute alkali, salt solutions	data not yet available	unaffected by dilute acids and alkalis, salt solutions ²	data not yet available
Size Capability	Organic immersion	generally unaffected	generally unaffected	data unavailable—expected to be generally unaffected	generally unaffected	data unavailable—expected to be generally unaffected
	Diameter (circular flats)	7 inches (9 inches on special order)	7 inches (9 inches on special order)	5 inches	7 inches	7 inches
	Thickness (circular flats)	1 inch	1 inch	$\frac{1}{2}$ inch	$\frac{1}{2}$ inch	$\frac{1}{2}$ inch

(1) Useful transmittance limits are taken at the wavelengths where transmittance falls below 10 percent for 2mm-thick sample

(2) Preliminary data (3) Actual maximum temperature limit is determined by pressure, length of exposure, type of atmosphere, etc.

CHARACTERISTICS OF KODAK

Availability

KODAK Film

Color Sensitivity

APPLICATIONS AND SPECIAL PROPERTIES

FACTORY STOCKED (In Certain Sizes)

SPECIAL ORDER

Spectrum Analysis, No. 3
Spectrum Analysis, No. 1
Fine Grain Positive
LINAGRAPH Recording
(ESTAR Base and ESTAR Thin Base)
LINAGRAPH Survey (ESTAR Base)

LINAGRAPH Ortho
LINAGRAPH Drift Survey

ROYAL-X Pan Recording
LINAGRAPH Shellburst (ESTAR Base)
LINAGRAPH Pan

TRI-X Pan
TRI-X Negative
DOUBLE-X Panchromatic Negative
TRI-X Reversal Movie

PLUS-X Pan
VERICHROME Pan (for oscillography)
PLUS-X Negative Movie

Direct Positive Panchromatic
Timing Negative
PLUS-X Reversal Movie
High Contrast Copy

High Speed Infrared
Infrared

EKTACHROME ER, Daylight Type
EKTACHROME ER, Type B (3200 K)
EKTACHROME MS, Daylight Type
KODACHROME II, Daylight Type
KODACHROME II, Professional,
Type A (3400 K)

SWR (Short Wave Radiation)

Spectroscopic, Type I
Spectroscopic, Type 103
Spectroscopic, Type 103a
Spectroscopic, Type IIa

Spectroscopic, Type III
Spectroscopic, Type IV
Spectroscopic, Type V
Spectroscopic, Type 649

BLUE

ORTHO

PAN

IR

COLOR
REVERSAL

UV

SEE BAR
CHART BELOW

Qualitative and trace-element spectrographic analysis
Quantitative and semiquantitative spectrographic analysis
For printing continuous-tone and line negatives; seismography
Instrumentation, oscillography, modulated-light and CRT photography

Instrument recording, such as oil-well logging

CRT, fluoroscope, bubble-chamber photography; also oscillography
For drift-survey cameras and photoclinometers, withstands 300 F

Highest speed for photo instrumentation with extremely short exposures
Photo-theodolite and bubble-chamber photography; high red sensitivity
High speed for instrumentation, CRT and electronic-flash photography

High speed for photorecording under adverse lighting conditions
High speed for motion pictures under adverse lighting conditions
High speed, low granularity and excellent sharpness
High-speed reversal film for use under adverse lighting conditions

Excellent gradation; for negatives which must be enlarged greatly
Suitable for oscillography with all types of light sources
For general-purpose indoor and outdoor motion-picture photography

Medium-speed, fine-grain, reversal film for making slides
Race-track photo-finish and CRT photography; processes in 25 seconds
Reversal film; for general-purpose motion-picture photography
For reproducing line copy at a reduction

Highest-speed between 700 and 900 m μ ; also sensitive to visible light
Moderate speed, very fine grain infrared-sensitive film

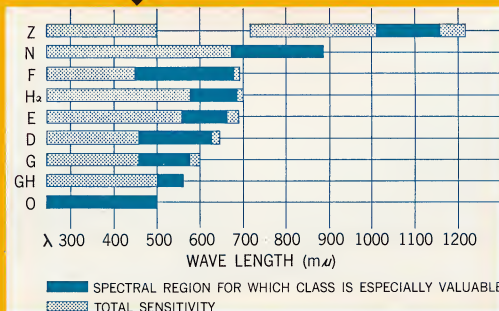
Highest speed for use under adverse lighting conditions
or with extremely short exposures
Medium speed; excellent sharpness and low graininess
Moderate speed; unmatched for excellent sharpness, lowest graininess,
highest color fidelity and wide exposure latitude

For use in vacuum ultraviolet; sensitive down to 7.5 m μ

Available in D, F, N, O, and Z sensitivity
Available in D, F, H α , and O sensitivity
Classes D, E, F, G, and O; for exposures longer than 2 to 5 minutes
Available in O sensitivity; for exposures longer than 2 to 5 minutes

Available in F and O sensitivity
Available in E, F, and N sensitivity
Available in E sensitivity
Classes F, GH, and O; resolving power above 2000 lines/mm

Spectroscopic Films Spectral Sensitivity Classes



NOTES

1. **For negative films:** Reciprocal of the tungsten exposure in meter-candle-seconds required to produce a density of 0.10 when the exposure is 1/10,000 second.

For reversal films: Reciprocal of the tungsten exposure in meter-candle-seconds required to produce a detectable density below Dmax at an exposure time of 1/10,000 second.

For Spectroscopic films: Reciprocal of the tungsten exposure in meter-candle-seconds required to a density of 0.60 above gross fog when the exposure time is 1 second. These are SA values.

These speed criteria were arbitrarily chosen to enable a direct comparison of the relative speeds of these films. Different speed relationships may occur for other density levels or conditions of exposure or development, or for other criteria for measuring speed—as in the case of "Meter Settings."

K PHOTORECORDING FILMS

Meter Setting ²									KODAK Developers ⁶	Sizes Available				
Photorecording Sensitivity ¹	Daylight Speed	Tungsten Speed	Copying Speed (Tungsten)	Contrast Class ³	Resolving Power Class ⁴	Granularity Class ⁵	KODAK Safelight Filter (WRATTEN Series No.)	16mm Rolls		135 Mag.	35mm Rolls	70mm Rolls	Wide Rolls	
4	—	—	64	M	M	M	1 (Red)	D-19			✓			
6	—	—	40	H	EH	VF	1 (Red)	D-19			✓			
2	1.2	0.3	10	H	VH	EF	1A (Light Red)	DEKTOL (1:2), D-11, D-16, D-76	✓		✓	✓		
	—	—	20	M	H	F	1 or 2	LINAGRAPH				✓	✓	
0	—	—	10	M	H	VF	1A or 2	LINAGRAPH					✓	
0	—	—	800	M	M	MC	2 (Dark Red)	D-19, LINAGRAPH, D-76	✓		✓			
6	—	—	25	M	H	EF	2 (Dark Red)	LINAGRAPH	✓	✓				
0	1250	1250	—	M	ML	C	Total Darkness	DK-50, D-19, DK-60a	✓		✓	✓		
0	500	—	—	M	H	M	Total Darkness	D-19, D-76	✓		✓	✓	✓	
0	—	400	—	M	M	MC	Total Darkness	D-19, LINAGRAPH, D-76	✓		✓			
0	ASA 400	—	—	M	M	F	Total Darkness	D-76, DK-50 (1:1), POLYDOL		✓	✓	✓		
0	320	250	—	M	M	MC	Total Darkness	D-76, DK-60a	✓		✓			
0	250	200	—	M	H	VF	Total Darkness	D-76, DK-60a	✓		✓			
0	200	160	—	M	M	—	Total Darkness	Standard B&W Reversal Process	✓					
0	ASA 125	—	—	M	H	EF	Total Darkness	D-76 (1:1), HC-110, POLYDOL		✓	✓	✓		
0	—	—	—	M	VH	EF	Total Darkness	D-19					✓	
0	80	64	—	M	H	EF	Total Darkness	D-76, DK-60a	✓		✓			
5	80	64	—	M	H	EF	Total Darkness	Direct Positive Film Developing Outfit			✓			
0	80	80	—	M	VH	F	Total Darkness	SD-44, SD-45			✓			
5	50	40	—	M	H	EF	Total Darkness	Standard B&W Reversal Process	✓					
5	—	—	64	H	EH	EF	Total Darkness	D-19		✓	✓			
0	50 ⁷	160 ⁷	—	M	M	M	Total Darkness	D-19, D-76	✓		✓			
6	—	20 ⁷	—	M	M	VF	7 (Green)	D-76, MICRODOL-X		✓	✓			
	160	32 ⁸	—	—	—	—	Total Darkness	{ Process E-2 (By user) Process K-12 } Can also be processed by Kodak and other Processing Laboratories	✓		✓	✓		
	80 ⁹	125	—	—	—	—	Total Darkness		✓		✓	✓		
	64	25 ¹⁰	—	—	—	—	Total Darkness		✓		✓	✓		
	25	12 ¹⁰	—	—	—	—	Total Darkness		✓	✓				
	25 ¹¹	40	—	—	—	—	Total Darkness		✓	✓				
	—	—	—	M	—	M	1 (Red)	D-19 (1:1)			✓			
0*	—	—	—	M*	M*	C*	Class D, E, F, Hα:	D-19	✓		✓			
2*	—	—	—	M*	ML*	MC*	Total Darkness	D-19	✓		✓			
	—	—	—	M*	ML*	MC*		D-19	✓		✓			
	—	—	—	M*	M*	M*	Class G,O:2	D-76	✓		✓			
*	—	—	—	H*	H*	M*		D-19	✓		✓			
**	—	—	—	EH**	VH**	F**	Class GH: 1A&OC	D-19	✓		✓			
**	—	—	—	EH**	EH**	EF**		D-19	✓		✓			
016*	—	—	—	EH*	EH*	EF*	Class N, Z:7	D-19, D-8 (2:1)	✓		✓			

2. For exposure meters marked for ASA Speeds or Exposure Indexes. Use the meter to evaluate reflected light from a KODAK Neutral Test Card (18-percent gray side) or incident light. If a "reflected-light" type of meter is used to measure a white card or the highest luminance being photographed, divide the "Meter Setting" value by 5.

3. Contrast Classifications:
M—Medium
H—High
EH—Extremely High

4. Resolving-Power Classifications:
L—Low (below 55 lines/mm)
ML—Moderately Low (56 to 68 lines/mm)
M—Medium (69 to 95 lines/mm)
H—High (96 to 135 lines/mm)
VH—Very High (136 to 225 lines/mm)
EH—Extremely High (above 225 lines/mm)

The data are for a test-object contrast of 1,000:1.

5. Granularity Classifications:
C—Coarse
MC—Moderately Coarse
M—Medium
F—Fine
VF—Very Fine
EF—Extremely Fine

6. The developers shown in dark-face type were used to determine the speed, contrast, and image-structure data shown. Slight differences in these characteristics may result when other developers are used, such as those developers shown in light-face type.

In particular, the contrast of many products can be varied by choice of development. For further data, see appropriate instruction sheet or Kodak publications.

7. With WRATTEN Filter No. 25 (A)
8. With WRATTEN Filter No. 78A
9. With WRATTEN Filter No. 85B
10. With WRATTEN Filter No. 80B
11. With WRATTEN Filter No. 85

*Data for "O" sensitivity
**Data for "E" sensitivity

For more information about sizes, prices, etc, contact:

Photo Recording Methods Sales Division
or Special Sensitized Products Sales Division
Eastman Kodak Company
Rochester 4, New York

Help Stamp Out Miserable Lecture Slides!

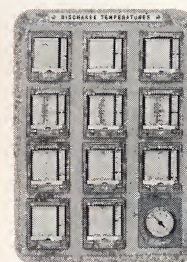
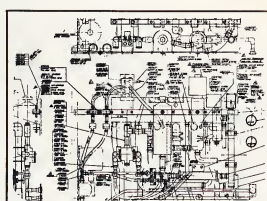
Your editor attends a number of meetings of technical societies each year and, since he travels on expense account, feels morally obligated to drop in on the papers sessions. A lot of papers are well-presented, well-illustrated, and contain a sizable serving of information. Other papers fall short of this mark, and most of these do so because of *miserable* slides.

You know what we mean. A *miserable slide* is one that contains 47,534 digits, each too small to see; a *miserable slide* includes a complete set of engineering drawings and specifications for a framostat; a *miserable slide* is a picture

of two dozen dials when only one is of interest.

To help you avoid some of these sins the next time you prepare a lecture, we have a new pamphlet entitled *Effective Lecture Slides* (KODAK Pamphlet No. S-22). It's only 8 pages long but contains a wealth of hints to improve your lecture slides. If you are a program chairman, you might want to obtain a quantity of these pamphlets so you can give one to each lecturer. Copies of this pamphlet are available in units of 100, at \$6.00 per 100. Send the order, with remittance, to Sales Service Division, Eastman Kodak Company, Rochester 4, N. Y. Single copies are free upon request.

#	NAME	COLLEGE	TAM	COTMAN	REG.	CONGR.	00
0	275687	161302	2287	4.88414	1.04209	3.92735	00
1	275688	161302	2287	4.88414	1.04209	3.92735	01
2	6197	1411	7317	7777	0478	0000	58
3	6197	1411	7317	7777	0478	0000	59
4	6197	1411	7317	7777	0478	0000	60
5	6197	1411	7317	7777	0478	0000	61
6	6197	1411	7317	7777	0478	0000	62
7	6197	1411	7317	7777	0478	0000	63
8	6197	1411	7317	7777	0478	0000	64
9	6197	1411	7317	7777	0478	0000	65
10	7319	0774	8033	4383	0822	0001	54
11	7319	0774	8033	4383	0822	0001	55
12	7319	0774	8033	4383	0822	0001	56
13	7319	0774	8033	4383	0822	0001	57
14	7319	0774	8033	4383	0822	0001	58
15	7319	0774	8033	4383	0822	0001	59
16	7319	0774	8033	4383	0822	0001	60
17	7319	0774	8033	4383	0822	0001	61
18	7319	0774	8033	4383	0822	0001	62
19	7319	0774	8033	4383	0822	0001	63
20	273432	260806	2.60806	2.60806	1.06112	3.20130	50
21	8715	0275	20901	4276	1200	87390	49
22	8715	0275	20901	4276	1200	87390	50
23	9270	0212	0382	3268	1436	08779	47
24	9270	0212	0382	3268	1436	08779	48
25	273428	260806	2.60806	2.60806	1.06112	3.20130	49
26	6388	0987	2130	4394	1789	06765	43
27	6388	0987	2130	4394	1789	06765	44
28	6388	0987	2130	4394	1789	06765	45
29	6388	0987	2130	4394	1789	06765	46
30	6388	0987	2130	4394	1789	06765	47
31	6388	0987	2130	4394	1789	06765	48
32	6388	0987	2130	4394	1789	06765	49
33	1504	0520	0838	06806	1947	55434	39
34	1504	0520	0838	06806	1947	55434	40
35	23562	0396	4040	3.40131	1.06112	3.58113	37
36	23562	0396	4040	3.40131	1.06112	3.58113	38
37	23562	0396	4040	3.40131	1.06112	3.58113	39
38	23562	0396	4040	3.40131	1.06112	3.58113	40
39	23562	0396	4040	3.40131	1.06112	3.58113	41
40	23562	0396	4040	3.40131	1.06112	3.58113	42
41	23562	0396	4040	3.40131	1.06112	3.58113	43
42	23562	0396	4040	3.40131	1.06112	3.58113	44
43	23562	0396	4040	3.40131	1.06112	3.58113	45
44	23562	0396	4040	3.40131	1.06112	3.58113	46
45	23562	0396	4040	3.40131	1.06112	3.58113	47
46	23562	0396	4040	3.40131	1.06112	3.58113	48
47	23562	0396	4040	3.40131	1.06112	3.58113	49
48	23562	0396	4040	3.40131	1.06112	3.58113	50
49	23562	0396	4040	3.40131	1.06112	3.58113	51
50	23562	0396	4040	3.40131	1.06112	3.58113	52
51	23562	0					



“All the Same Emulsion, Please”—Part II

Back in issue number 1 of *Kodak Tech Bits*, we described how to interpret the emulsion codes for Kodak plates. Now we are going to try to do the same thing for some films.

Occasionally, customers specify that all the films of one type for a particular order be from the same emulsion batch. Where possible, we try to accommodate such requests whenever the customer has a real need. When the codes on each package of film vary and do not *seem* to indicate the same emulsion batch, please do not get angry with us. Only part of the codes indicate the emulsion batch.

The cryptographers in our Kodak Park Works have devised a code that even the Russians couldn't crack. In fact, even our experts have to consult code books. Unlike the codes for plates, film emulsion codes have several forms and there are a number of exceptions to the rules given below. Whenever there is any doubt in interpreting film emulsion codes, contact your Kodak Technical Sales Representative, or one of the Sales Division Product Specialists here in Rochester.

Emulsion code numbers which are hyphenated are the easiest to interpret. The first group of numbers represents the product type or kind. The second group indicates the emulsion batch number. Any remaining codes are internal control numbers which keep our computers happy. Take, for example, the code **2474-51-01**. The **2474** indicates the product (in this case, KODAK LINAGRAPH Shellburst Film, ESTAR Base), **51** indicates the emulsion batch number, and the remaining codes are for internal control. For some films, the hyphens are omitted and the groups of codes are separated by spaces. Sometimes the groups are not separated at all and appear as **247451K**. Another variation is when the product type designation (which can be either 2 or 4 digits) is preceded by a letter.

For all KODAK Spectroscopic Films, KODAK SWR Film, and KODAK Personal Neutron Monitoring Film, the first 5 digits of the emulsion code represent the batch number.

If you ever have occasion to contact us about a particular emulsion, please furnish all codes that appear on the package. (Our computers insist on having the entire code.)

Random Bits

"How big is a roll of film?" may sound like the moot question "How long is a piece of string?" but not if you know the length (F) of the film in feet, the thickness (t) of the film in inches, and the diameter (d) of the core in inches. To get the diameter (D) of the roll of film in inches, you merely plug into the formula

$$D = \sqrt{\frac{48 Ft + d^2}{\pi}}$$

and turn the crank. ■ Here's a useful gimmick to clean photographic plates and negatives and optics: Use the "EFFA Duster" sold by Ernest F. Fullam, Inc., P. O. Box 444, Schenectady 1, N. Y. It is a pressurized can of laboratory clean Freon. ■ Here's some good news for those photo-micrographers who like 35mm color transparencies they can process themselves. KODAK EKTACHROME-X Film, balanced for daylight, can be used with a 6-volt ribbon filament tungsten lamp (2900 K) by using a KODAK WRATTEN Filter No. 80C, plus a Light Balancing Filter No. 82C. This combination results in an effective exposure index of 24. Other lamps of higher color temperature can be used if the Light Balancing Filter is changed to an 82A or 82B. ■ All sizes of KODAK High Resolution Plates that are smaller

than 4 by 5 inches are now of a quality suitable for micro-electronics applications. ■ Every so often someone writes to us and asks for pamphlet "220-L-KP-E." A code of this sort appears in the lower *right* corner of the back page of all Kodak publications. If you are one of those who likes to read codes, here is the secret: the first numbers (220) are the job number; next, a key to the printing process (L for lithography); then there is a code (KP for Kodak Park) to indicate the printer; and finally the quantity (E = 5) printed in thousands. The "6-62 Major Revision" indicates that the pamphlet was revised in June, 1962. Now that you know our innermost secrets, do us a favor and don't use this code for ordering our publications: Order pamphlets and Data Books by the title and KODAK Publication Number in the lower *left* corner on the back page. ■ If you like to listen to a radio while working in a darkroom, here is a way to make the dial "safe." Simply remove the dial lamp from the set and paint the dial-lamp globe with dark-red fingernail polish, and then replace the lamp. If you can't bear missing a single episode of "Ben Casey," you can make the TV "safe" by placing a piece of KODAGRAPH Sheeting, Orange, over the picture tube. ■ Merry Christmas and Happy New Year!

TECH BITS BULLETIN BOARD

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Free Pamphlets:

Photography Under Arctic Conditions (C-9)

Black-and-White Transparencies with PANATOMIC-X Film in Magazines (F-19)

Modern Processing for Permanence (J-19)

Removing Fixer Stains from Clothing (J-21)

Motion Pictures through the Microscope (N-2)

KODAK LINAGRAPH Ortho Film (P-57)

Single copies of free pamphlets are supplied on request to the Sales Service Division, Eastman Kodak Company, Rochester 4, New York.

New KODAK Products

DOUBLE-X AEROGRAPHIC Film (ESTAR Base), Type 1405 (9½-inch rolls)—Improved, general-purpose mapping film of higher speed (Exposure Index of 125) and acutance on 4-mil polyester base.

KODALITH LR Film, ESTAR Base (Sheets and rolls)—Extremely high-contrast ortho film for making laterally reversed

line and halftone negatives. When exposed through the 4-mil polyester base, has about the same speed as KODALITH Ortho Film, Type 3.

LINAGRAPH Recording Film, ESTAR Thin Base (6-, 8-, 8½-, and 12-inch rolls)—Photographic characteristics identical to LINAGRAPH Recording Film (ESTAR Base). Thinner 2½-mil polyester base permits loading longer lengths into conventional magazines.

VERSAMAT Film Processor, Model 11A—Improved version of VERSAMAT Film Processor, Model 11.

Sound Recording Tape, DUROL Base (1- and 1½-mil triacetate) and **Sound Recording Tape, Polyester Base** (1½- and 1-mil polyester)—New type of oxide layer features lower print-through characteristics than any other tape on the market without loss of output.

You're Invited

We invite you to visit the Kodak booth at the trade shows associated with the conventions of the following organizations:

December 6-10: Society of Reproduction Engineers, Cleveland, Ohio

March 2-6: Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Pittsburgh, Pa.

Sales Service Division

EASTMAN KODAK COMPANY • ROCHESTER, N. Y. 14650

EASTMAN KODAK COMPANY

GENERAL OFFICES
343 STATE STREET

ROCHESTER, NEW YORK 14650

TELEPHONE
AREA CODE 716 LOCUST 2-6000

August 27, 1964

Dear Sir:

Thank you very much for your recent request for information on Kodak Photoplast Plates. These plates are described in detail in the enclosed pamphlet. Photoplast Plates are available as a stocked item through your local Kodak Dealer in the following sizes:

	<u>Plates Per Pkg.</u>	<u>List Price Per Pkg.</u>
8 x 10" x .060"	12	\$ 52.45
8 x 10" x .130"	6	29.70
8 x 10" x .250"	6	33.00

The minimum-order requirement is one package, and normal delivery is from stock.

Photoplast Plates can also be made available upon special order in any desired rectangular or square size from 8 x 10" to approximately 30 x 60". We shall be happy to quote you price and availability if you require an unstocked size.

We appreciate the opportunity to tell you about one of our products and hope that if you have further questions, you will not hesitate to contact us.

Yours very truly,

Wm. T. Swanton

Special Sensitized Products Sales

WTSwanton:LAS
Enc.